REMARKS

Allowable subject matter:

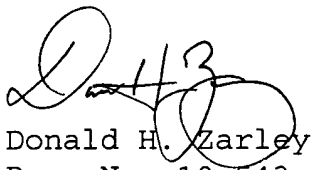
The examiner has objected to claims 5-8 as being dependent on rejected base claims, but allowable if rewritten in independent form. Accordingly, applicant has previously amended claims 5 and 7 to be in independent form. In the November 25, 2002, Amendment applicant mistakenly added an unnecessary limitation twice, both in claim 5 and in claim 7. Accordingly, this Supplemental Amendment removes this unnecessary language.

CONCLUSION

In view of the above amendments and remarks, applicant believes claims 1-3 and 5-17 are in condition for allowance, and applicant respectfully requests allowance of such claims. If any issues remain that may be expeditiously addressed in a telephone interview, the examiner is encouraged to telephone the undersigned at 515/558-0200.

Any fees or extensions of time believed to be due in connection with this amendment are enclosed with this amendment; however, consider this a request for any extension inadvertently omitted, and charge any additional fees to Deposit Account No. 50-2098.

Respectfully submitted,



Donald H. Zarley
Reg. No. 18,543
ZARLEY LAW FIRM, P.L.C
Capital Square
400 Locust Street, Suite 200
Des Moines, IA 50309-2350
Phone No. (515) 558-0200
Fax No. (515) 558-7790
Customer No. 34082
Attorneys of Record

- - - - - - bjs - - -

VERSION WITH MARKINGS TO SHOW CHANGES MADE DECEMBER 23, 2002

In the Claims:

Claims 5 and 7 have been amended as follows:

5. (Twice Amended) A system for detecting the level of liquid in a vessel, comprising:

a detector assembly including

a thermally conductive substrate,

a heater mounted on said substrate such that said heater is thermally coupled to the interior of the vessel, said heater being able to be actuated to add heat to the surface of the substrate thermally coupled to the interior of the vessel, and

a sensor mounted on said substrate in proximity to said heater such that discrete elevations of the interior of the vessel are thermally coupled to corresponding longitudinal portions of said sensor to generate an electrical signal defining a temperature signal, said correspondence being incrementally continuous such that the elevations corresponding to said portions of said sensor increase from one to the other of the ends of said sensor, said sensor being able to be actuated to detect the temperature in the vessel in proximity to the sensor indicative of the temperature detected by said sensor, said sensor having a vertical dimension sufficiently large such that said temperature signal will vary in proportion to said longitudinal portion of said sensor thermally coupled to the liquid;

a processor electrically connected to said sensor for receiving said temperature signal after actuation of said heater, said processor being programmed to use said

temperature signal to calculate the elevation of the upper surface of the liquid in the vessel thereby to generate an electrical signal defining an elevation signal indicative of the elevation of the liquid upper surface relative to the lower end of said sensor;

an interface electrically connected to said processor for receiving said elevation signal for use as the basis for communicating to the user the elevation of the liquid upper surface; and

a power supply electrically connected to said heater, sensor, processor, and interface, ~~and wherein said sensor comprises a potentiometer wherein the resistance to electrical conductivity of said sensor varies in proportion to the temperature detected by it, said temperature signal being equal to said resistance, said programming of said processor comprising using said temperature signal to measure said resistance of said sensor, said programming further comprising using said resistance to calculate the elevation of the liquid upper surface,~~

~~wherein said sensor comprises a potentiometer wherein the resistance to electrical conductivity of said sensor varies in proportion to the temperature detected by it, said temperature signal being equal to said resistance, said programming of said processor comprising using said temperature signal to measure said resistance of said sensor, said programming further comprising using said resistance to calculate the elevation of the liquid upper surface,~~

wherein said sensor is defined by an intermediate sensor, said system further comprising: an upper sensor mounted on said substrate adjacent to the upper end of said

intermediate sensor; and a lower sensor adjacent to the lower end of said intermediate sensor, said upper and lower sensors being thermally coupled to the interior of the vessel to detect the respective temperatures therein in proximity to said upper and lower sensors, said upper and lower sensors being able to be actuated to produce respective electrical signals defining temperature signals indicative of the respective temperatures detected by them, said upper and lower sensors each comprising a potentiometer wherein the resistance to electrical conductivity of each of said upper and lower sensors varies in proportion to the respective temperatures detected by them, said temperature signals of said upper and lower sensors being equal to said respective resistance values thereof, said processor being further programmed to calculate the distance between said lower sensor and the liquid upper surface according to the following equation:

$$l = \frac{R_i - R_{vp}}{R_{lq} - R_{vp}}$$

where l = longitudinal fraction of said intermediate sensor below said liquid upper surface;

R_i = resistance of said intermediate sensor;

R_{vp} = resistance of said upper sensor when exposed to vapor only; and

R_{lq} = resistance of said lower sensor when exposed to liquid only,

said processor being further programmed to calculate the vertical component of "l" for use as the basis for said generation of said elevation signal.

7. (Twice Amended) A system for detecting the level of liquid in a vessel, comprising:

a detector assembly including

a thermally conductive substrate,

a heater mounted on said substrate such that said heater is thermally coupled to the interior of the vessel, said heater being able to be actuated to add heat to the surface of the substrate thermally coupled to the interior of the vessel, and

a sensor mounted on said substrate in proximity to said heater such that discrete elevations of the interior of the vessel are thermally coupled to corresponding longitudinal portions of said sensor to generate an electrical signal defining a temperature signal, said correspondence being incrementally continuous such that the elevations corresponding to said portions of said sensor increase from one to the other of the ends of said sensor, said sensor being able to be actuated to detect the temperature in the vessel in proximity to the sensor indicative of the temperature detected by said sensor, said sensor having a vertical dimension sufficiently large such that said temperature signal will vary in proportion to said longitudinal portion of said sensor thermally coupled to the liquid;

a processor electrically connected to said sensor for receiving said temperature signal after actuation of said heater, said processor being programmed to use said temperature signal to calculate the elevation of the upper surface of the liquid in the vessel thereby to generate an electrical signal defining an elevation signal indicative of the elevation of the liquid upper surface relative to the lower end of said sensor;

an interface electrically connected to said processor for receiving said elevation signal for use as the basis for communicating to the user the elevation of the liquid upper surface;

a power supply electrically connected to said heater, sensor, processor, and interface, ~~and wherein said sensor comprises a potentiometer wherein the resistance to electrical conductivity of said sensor varies in proportion to the temperature detected by it, said temperature signal being equal to said resistance, said programming of said processor comprising using said temperature signal to measure said resistance of said sensor, said programming further comprising using said resistance to calculate the elevation of the liquid upper surface,~~

~~wherein said sensor comprises a potentiometer wherein the resistance to electrical conductivity of said sensor varies in proportion to the temperature detected by it, said temperature signal being equal to said resistance, said programming of said processor comprising using said temperature signal to measure said resistance of said sensor, said programming further comprising using said resistance to calculate the elevation of the liquid upper surface,~~

wherein said sensor is defined by an intermediate sensor, said system further comprising: an upper sensor mounted on said substrate adjacent to the upper end of said intermediate sensor; and a lower sensor adjacent to the lower end of said intermediate sensor, said upper and lower sensors being thermally coupled to the interior of the vessel to detect the respective temperatures therein in proximity to said upper and lower sensors, said upper

and lower sensors being able to be actuated to produce respective electrical signals defining temperature signals indicative of the respective temperatures detected by them, said upper and lower sensors each comprising a potentiometer wherein the resistance to electrical conductivity of each of said upper and lower sensors varies in proportion to the respective temperatures detected by them, said temperature signals of said upper and lower sensors being equal to said respective resistance values thereof, said processor being further programmed to calculate the distance between said lower sensor and the liquid upper surface according to the following equation:

$$l = \frac{R_i - R_{vp}}{R_{lq'} - R_{vp'}}$$

Where l = number of increments between a lower end of said intermediate sensor and the liquid upper surface;

L = total number of increments between an upper end and said lower end of said intermediate sensor (any number of increments are possible, higher number increases resolution of calculation and the actual count is arbitrary and determined only by resolution requirements);

R_i = resistance of said intermediate sensor;

R_{vp} = resistance of said upper sensor without scaling;

$R_{vp'}$ = resistance of said upper sensor at the observed temperature when exposed to vapor only, scaled by dividing by the total number of increments; and

$R_{lq'}$ = resistance of said lower sensor at the observed temperature when exposed to liquid only, scaled by dividing by the total number of increments;

said processor being further programmed to calculate the vertical component of "l" for use as the basis for said generation of said elevation signal.